# ISSUE PAPER:
# FOR THE DECEMBER 12 PUBLIC WORKSHOP
# WINDOW SHADING (INTERIOR SHADING):

## INTRODUCTION

Many parts of California have hot summers resulting in substantial home cooling energy use. A significant portion of this need for cooling energy is caused by solar radiation through windows. To reduce the need for cooling, the Energy Commission has included shading requirements in the building efficiency standards since 1983. These shading requirements were based on the energy savings achieved by double pane fenestration products in combination with interior draperies and exterior shade screens. This combination of measures was demonstrated to have the lowest life cycle cost. The Commission considered basing its standard on the use of roller shades rather than interior draperies or exterior shade screens. However, due to their short estimated life, the Commission found roller shades did not have the lowest life cycle cost.

In implementing this standard, the Commission has allowed a variety of shading devices to be used for compliance credit. One of the more popular devices used for compliance has been roller shades. This has subsequently resulted in buildings that do not meet the intent of the standards since roller shades are not a reliable, long term energy efficiency feature. Field research has shown that roller shades often don't get installed or are removed before occupancy. For those buildings that achieved compliance assuming installation of exterior shade screens, there also is a tendency for the shade screens to not be installed or to be removed, again not achieving the intended energy savings. Even when roller shades or shade screens are installed, they often have a short (less than three year) useful life.

Staff proposes to modify the method used to determine compliance with the standard and to limit the use of interior window treatments and exterior shade screens for achieving compliance.

## PUBLIC COMMENT:

Staff conducted an informal building department survey, in which eliminating or modifying some aspect the interior shading credit was the highest priority for revisions to the standards. In the same survey, commenters encouraged the Commission to provide more effective and reliable ways to reduce solar radiation than interior shading devices. Some of the suggested devices were overhangs, trellises, self-shading, better orientation, windows with inherent shading characteristics, and exterior shading devices.

## STAFF ANALYSIS

### Current Methods available for compliance

The current standards are based on achieving one of two levels of shading. These are included in the alternative component packages as overall shading coefficients of 0.66 and 0.40. The 0.66 value represents a double pane window with an interior drapery. The 0.40 value represents a double pane window with interior drapery and exterior shade screen. Compliance may be achieved with a variety of shading devices. Table 1 shows the shading values that are currently allowed for shading devices. To determine the shading coefficient for the overall assembly, the shading coefficients for the interior shade, the fenestration and the exterior shading device are combined using the Commission's shading coefficient worksheet. Roller shades are the only interior shading device that currently achieves compliance with the 0.40 SC value. There are currently four exterior shading devices that are available to achieve compliance; woven sun screens, louvered sun screens, roll down awnings or slats, and Outside Venetian blinds.

## Compliance issues

According to reports from building departments and builders, a large percentage of shading devices are not installed or do not remain installed in buildings after they are completed. This appears to reflect a traditional occupant pattern in which shading devices are not a permanent part of the building, are viewed by occupants as aesthetic amenities to the building and are often changed by occupants independent of the builder's choice. From a customer satisfaction perspective, decisions related to window treatments are usually better left to the home purchaser's decorating plans without involvement from the builder. Based on these reports, staff believes it is inappropriate to put a builder in the position of choosing to achieve compliance with devices that are not permanent parts of the building and dominantly under the control of the occupant instead of the builder. Staff also believe it is inappropriate to assume that energy savings is being achieve by interior and most exterior shading devices and therefore believes those devices should not be allowed for determining compliance with the building efficiency standards.

## Alternative methods

Staff has examined alternative methods for achieving compliance with the standards while avoiding the use of alternatives that are primarily under the control of the building occupant instead of the builder or building official. This criterion limits the alternatives to fenestration features installed as part of the building and overhangs. Since overhangs are sensitive to building orientation, staff proposes they be allowed as a compliance alternative, but not be used as part of the basis of the standard.

Although the specific interior and exterior shading devices in a building are under the control of the occupant, surveys have indicated that a majority of building occupants install some type of shading device, draperies and mini-blinds being popular choices. Similarly, surveys show that a majority of buildings include bug screens on about half of the windows. When calculating the overall shading coefficient of fenestration products, the analysis needs to include the effects of typical installation of devices, even though these may not be installed by the builder.

Using the shading coefficient worksheet, staff has calculated the shading coefficient that the fenestration (glazing and frame) will need to meet in order to achieve a 0.40 overall shading coefficient when combined with a standard interior drapery and bug screens on half the windows. To meet the 0.40 shading coefficient requirement of the standard will require fenestration with a shading coefficient of 0.44 (a Solar Heat Gain Coefficient for a fenestration product of 0.38). This may be achieved by fenestration with 20% framing and a SC for the glass alone of 0.55, or by a fenestration with 10% framing and a SC for glass alone of 0.49

Table 2 shows the SHGC values for fenestration products based on products included in the WINDOW 4.0 program. The Glass Type description is that used by the WINDOW 4.0 program. The SC column shows the center of glass shading coefficient. Staff used the SC value to calculate SHGC values for products that would include framing assumptions of 10 percent and 20 percent framing. The U-value column shows the approximate U-value for the product listed in the WINDOW 4.0 program based on a specific framing design.

| TABLE 2 FENESTRATION PRODUCTS | | | | |
|---|---|---|---|---|
| Glass Type | SC | SHGC | | U-value |
| | | 10 Percent Framing | 20 Percent Framing | |
| Standard Double | 0.89 | 0.7 | 0.62 | 0.47 |
| GREEN 11 | 0.71 | 0.56 | 0.49 | 0.47 |
| **LOW-E TINT** | 0.45 | **0.35** | **0.31** | 0.34 |
| **SPEC-SL-CLEAR 500** | 0.51 | 0.4 | **0.35** | 0.33 |
| **SCBRNZ 5130** | 0.4 | **0.31** | **0.28** | 0.47 |
| AZRLT3 5017 | 0.54 | 0.42 | 0.38 | 0.47 |

As can be seen from this table, there are a variety of alternative fenestration product alternatives that will achieve the 0.38 SHGC required to meet the 0.40 SC value required by the building efficiency standards (shown as bold values in the table).

There is limited data on the use of high cost exterior shading devices such as louvered shade screens, awnings, exterior slats, roller slats, and exterior Venetian blinds. The high cost of these products limit their use to special building designs where the shading device is often integrated into the architectural design of the building. These types of designs are more likely to assure that the devices remain on the building after occupancy. The limited use of these designs also limits the risk that they will result in a substantial loss of statewide energy savings even if some of the devices are removed by occupants. In the interest of encouraging innovative design approaches, staff believes these specific products should still be allowed for achieving compliance with the building efficiency standards.

## STAFF RECOMMENDATION

Staff recommends the Commission:

- Maintain the 0.40 shading coefficient (or equivalent SHGC) standard level in the Alternative Component Packages of the building efficiency standards,
- For compliance purposes, fix the value for interior shading at a shading coefficient of 0.78 for both standard and proposed designs,
- For compliance purposes, fix the value for exterior shading devices at a shading coefficient of 0.87 representing bug screens applied to half the vertical fenestration for both standard and proposed designs,
- Allow compliance credit for the shading coefficient (or SHGC) of fenestration products, exterior shading devices, including louvered shade screens, awnings, exterior slats, roller slats and exterior Venetian blinds, and architectural shading, including overhangs, trellises, and building self-shading.